

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2017/2018

PCF0145 – CELL AND FUNCTION (Foundation in Life Sciences)

23 OCTOBER 2017
9.00 a.m – 11.00 a.m
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of 8 printed pages excluding the cover page with 5 structured questions.
2. Answer **ALL** questions.
3. Distribution of marks for each section/question is given.

STRUCTURED QUESTIONS [100 MARKS]

Instructions: Answer **ALL** questions. Write your answers in the Answer Booklet.

Question 1 [20 marks]

- a. State the correct pre-zygotic barriers for these statements below.
- Male fireflies will signal to their female counterparts by flashing their lights in specific patterns.
 - Eastern spotted skunks will breed in late winter, while western spotted skunks breed in fall.
 - Two populations of flies exist in the same geographical area but one group lives in the soil and another lives on the surface of the water.
 - Africa is home to a group of small, arboreal primates called bushbabies. The genitalia of a male bushbaby will only fit into the genitalia of a female belonging to the same species.
- (4 marks)
- b. State the difference between:
- biotic component and abiotic component
 - comparative embryology and comparative anatomy
- (4 marks)
- c. The wildlife workers captured 328 penguins on an island, marked them and allowed them to mix with the rest of the population. One month later, they captured 200 penguins on the same island and 64 of them were found to be marked. Calculate the population density of penguins on the island using the mark-recapture method formula.
- (2 marks)
- d. **Figure 1** shows newborn baby weights as a type of natural selection.
- Define natural selection. (1 mark)
 - What type of natural selection is shown in **Figure 1**? (1 mark)
 - Briefly explain the variation of newborn babies shown in **Figure 1**. (3 marks)
 - What does it mean by “fitter organisms are naturally selected”? (1 mark)

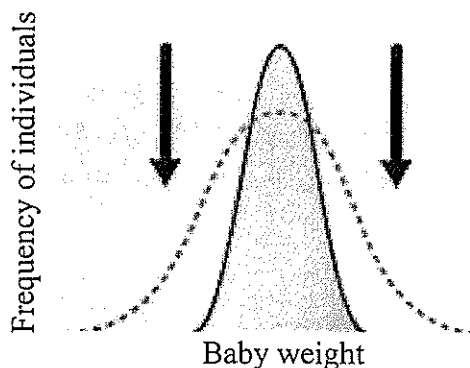


Figure 1

Continued.....

e. With suitable examples, briefly explain the following ecological terms.

- i. Commensalism
- ii. Mutualism

(4 marks)

Question 2 [20 marks]

a. Monosaccharides may be used to build a wide variety of biological structures.

Figure 2 shows two monosaccharide molecules.

- i. Draw a diagram to show how these molecules can bond together. (2 marks)
- ii. State the name of the bond you have drawn. (1 mark)
- iii. What is a polysaccharide? Give an example of a polysaccharide. (2 marks)

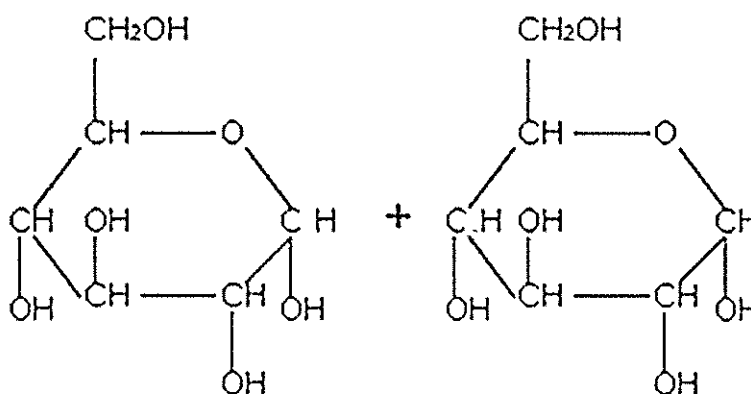


Figure 2

b. A group of students decided to carry out an investigation to find out how enzyme activity is affected by temperature changes. They put samples of amylase and starch into two test tubes. Amylase is an enzyme that breaks down starch into maltose. The optimum temperature for amylase enzyme is at 37°C.

- i. What is meant by the term “optimum temperature”? (1 mark)
- ii. What will happen to the rate of reaction if:
 - the temperature is increased to 37°C?
 - the temperature is decreased to 0°C? (1 mark)
- iii. What is an inhibitor? Explain how inhibition is achieved. (3 marks)

Continued.....

- c. **Figure 3** shows the roadmap of cellular respiration.
- Provide the overall chemical equation for cellular respiration. (1 mark)
 - What happens to the high energy electrons held by NADH if there is no oxygen present? (1 mark)
 - Briefly explain how the electron transport chain generates ATP. (5 marks)

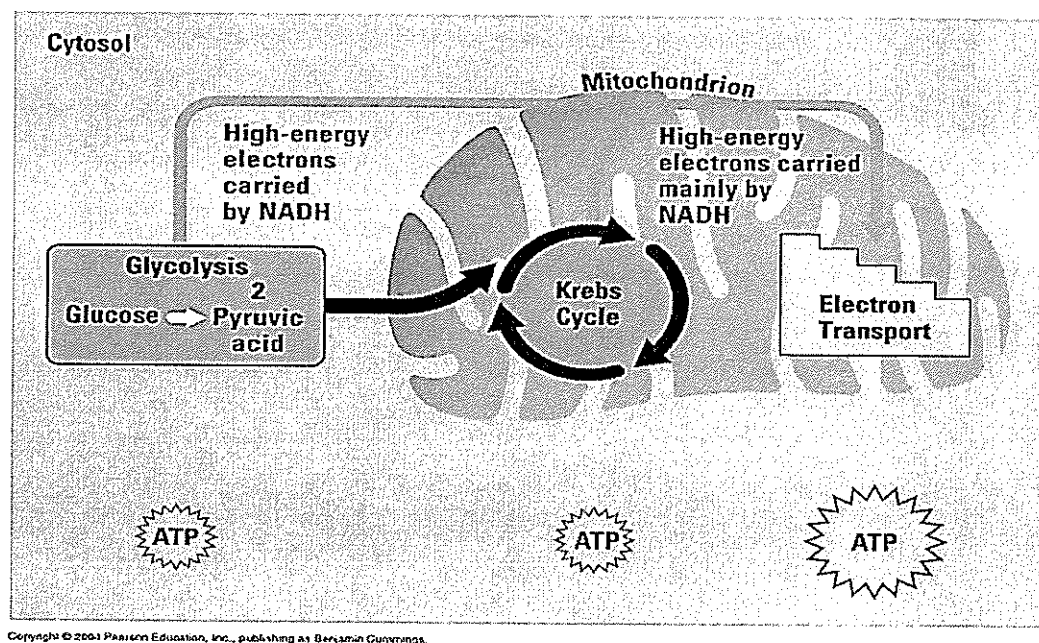


Figure 3

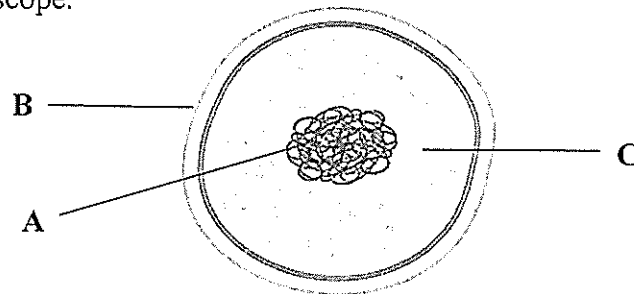
- d. Define these terms below.
- Facultative anaerobes
 - Obligate anaerobes
 - Obligate aerobes

(3 marks)

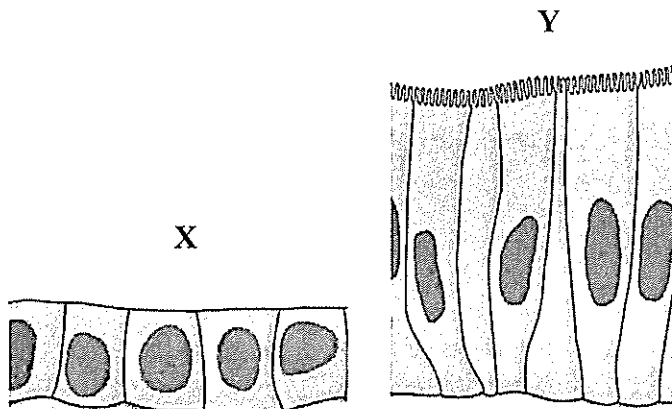
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Question 3 [20 marks]

- a. **Figure 4** shows the transmission electron micrograph of a cell.
- Identify the type of cell shown in **Figure 4**. (1 mark)
 - Name the structures labelled **A** and **B**. (2 marks)
 - Name an organelle that would be found in region **C**. (1 mark)
 - State the difference between a scanning electron microscope and a transmission electron microscope. (2 marks)

**Figure 4**

- b. **Figure 5** shows two types of simple epithelium tissue.
- Name the type of epithelium tissues labeled **X** and **Y**. (2 marks)
 - List **two** functions of epithelium tissue. (2 marks)

**Figure 5****Continued.....**

c. **Figure 6** shows the Calvin cycle in photosynthesis.

- State the source of NADPH used in the Calvin cycle.
- Explain the main stages of this cycle.

(1 mark)

(5 marks)

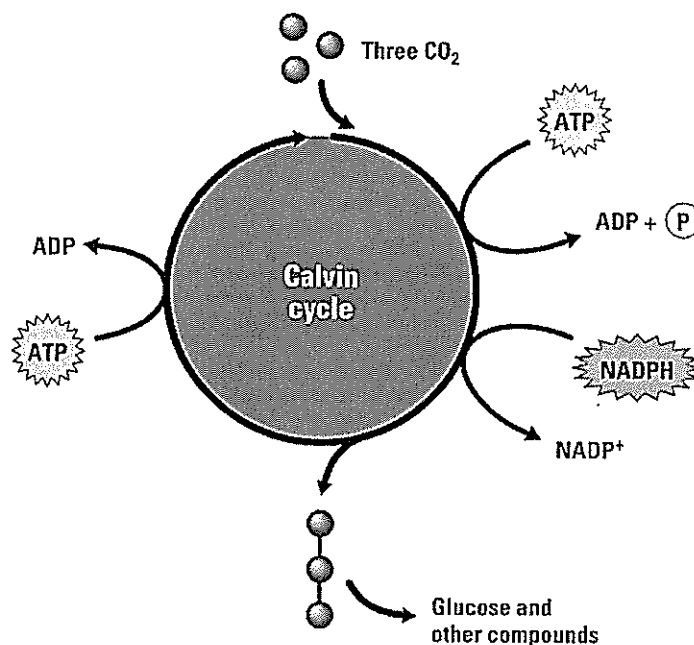


Figure 6

d. **Figure 7** shows the carbon fixation pathway of a plant.

- Give an example of a plant that carries out this type of carbon fixation. (1 mark)
- What is the name of the carbon fixation pathway in **Figure 7**? (1 mark)
- State **two** advantages of the plant that has this type of carbon fixation pathway. (2 marks)

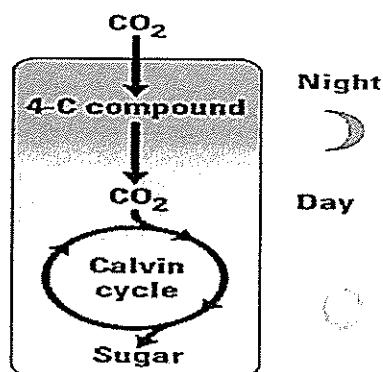
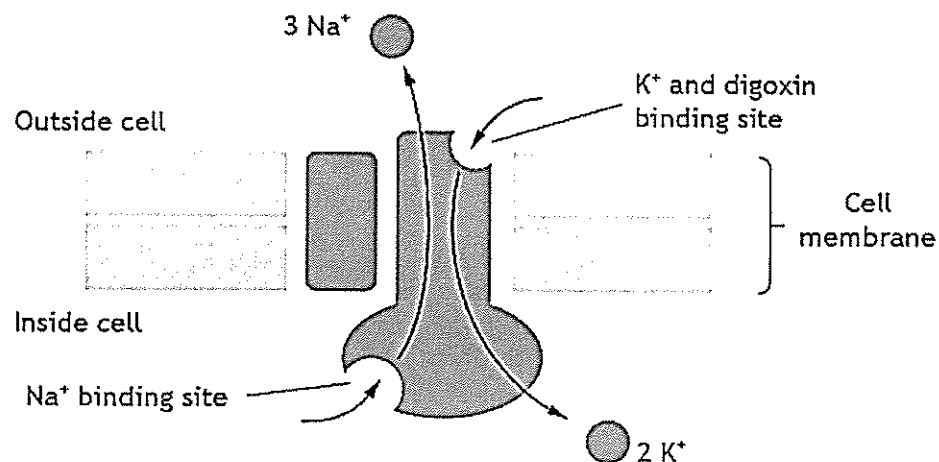


Figure 7

Continued.....

Question 4 [20 marks]

- a. **Figure 8** shows the sodium-potassium pump.
- State the function of the sodium-potassium pump. (2 marks)
 - Digoxin is a chemical that inhibits the sodium-potassium pump by binding to the K^+ binding site as shown in **Figure 8**. Explain why binding by digoxin prevents further binding of sodium (Na^+) ions by the pump. (4 marks)



- b. Determine whether these actions below are under the sympathetic nervous system or the parasympathetic nervous system.
- Reduces blood flow to skeletal muscle.
 - Inhibits digestion.
- (2 marks)
- c. State **two** characteristics of an axon that can increase the conduction velocity. (2 marks)
- d. Kidneys filter our blood and produce urine every day.
- Briefly describe the filtration process in the kidney. Include efferent and afferent capillaries in your answer. (3 marks)
 - Explain why the epithelial cells of the proximal tubule have many mitochondria in them. (3 marks)
 - Name **two** substances that are reabsorbed into the blood from the proximal tubule, apart from water. (2 marks)
- e. What happens in the liver if the blood glucose level falls? (2 marks)

Continued.....

Question 5 [20 marks]

- a. How do the guard cells function in the opening of the stomata? (4 marks)
- b. **Figure 9** shows the molecule of hemoglobin.
- Identify **one** type of secondary structure shown in the hemoglobin molecule in **Figure 9**. (1 mark)
 - Discuss the term “affinity” in relation to oxygen binding to hemoglobin. (3 marks)

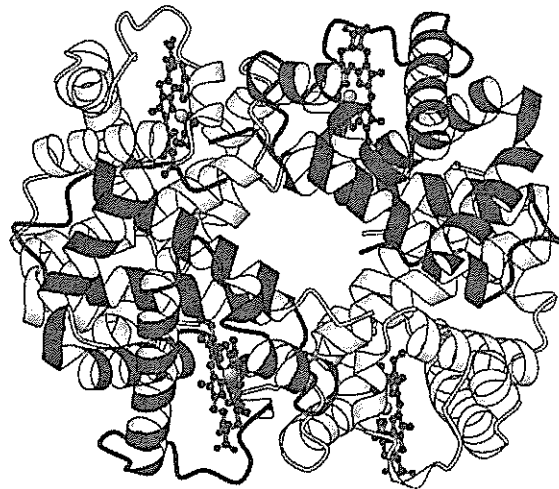


Figure 9

- c. Describe the function of SA node and Purkinje fibers in the initiation and coordination of the heart. (6 marks)

Continued.....

- d. **Figure 10** shows a potato tuber before and after the breaking of its bud dormancy.
- Name the hormones responsible for: (2 marks)
 - initiating bud dormancy
 - breaking bud dormancy
 - The shoot in potato **Y** demonstrates apical dominance. Describe how the information provided in **Figure 10** supports this statement. (2 marks)
 - Give an advantage of the potato plant of apical dominance. (1 mark)
 - How can apical dominance phenomenon in a plant be prevented? (1 mark)

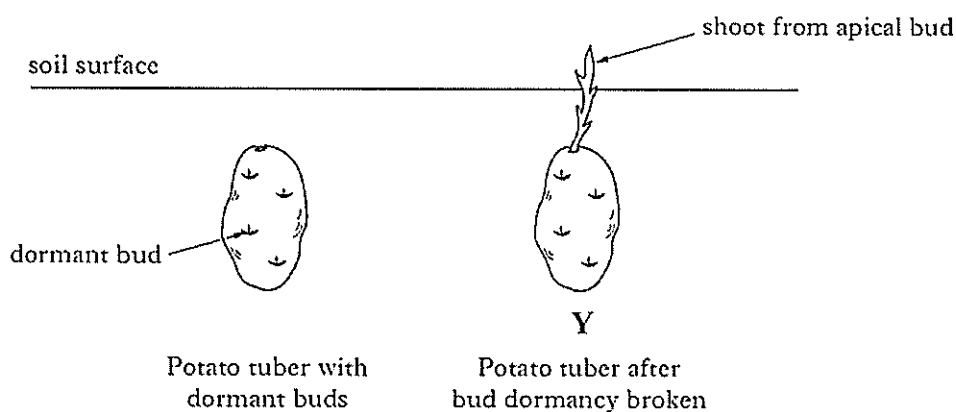


Figure 10